Electronic Version

Stylesheet Version v1.1.1

Claims

[c1] 1. An UV photodetector, comprising:

a substrate;

a GaN-based semiconductor layer, disposed on the substrate, wherein the GaN-based semiconductor layer comprises a first protrusion portion;

a high-resistivity GaN-based interlayer, disposed on the first protrusion portion of the GaN-based semiconductor layer, and a material of the GaN-based interlayer comprising $Al_xIn_yGa_{1-x-y}N$, wherein $x \geq 0$, $y \geq 0$, $1 \geq x + y$;

a first electrode, disposed on the GaN-based interlayer; and

a second electrode disposed on a portion of the GaN-based semiconductor layer except for the first protrusion portion.

[c2] 2. The UV photodetector of claim 1, further comprising a first bonding pad, wherein the first bonding pad is disposed on the first electrode.

[c3] 3. The UV photodetector of claim 1, further comprising a second bonding pad, wherein the second bonding pad is disposed on the second electrode.

[c4] 4. The UV photodetector of claim 1, wherein the substrate is comprised of an aluminum oxide (sapphire) substrate, a silicon carbide (SiC) substrate, a zinc oxide (ZnO) substrate, a silicon substrate, a gallium phosphide (GaP) substrate, and a gallium arsenide (GaAs) substrate.

[c5] 5. The UV photodetector of claim 1, wherein the high-resistivity GaN-based interlayer is constructed by doping at least one dopant selected from a group consisting of iron (Fe), magnesium (Mg), zinc (Zn), copper (Cu), arsenide (As), phosphorus (P), carbon (C) and beryllium (Be) or by a GaN-based semiconductor layer formed by a low temperature process (a temperature of growth less than 800°C).

[c6] 6. The UV photodetector of claim 1, wherein the GaN-based semiconductor layer comprising:
a nucleation layer, disposed on the substrate;
an ohmic contact layer, disposed on the nucleation layer, wherein the ohmic contact layer comprises a second protrusion portion; and
an active layer, disposed on the second protrusion portion, wherein the first protrusion portion is constructed by the second protrusion portion of the ohmic contact layer and the active layer.

[c7] 7. The UV photodetector of claim 6, wherein a material

of the nucleation layer comprises $Al_aIn_bGa_{1-a-b}N$ semiconductor, wherein a, b ≥ 0 and 0≤a+b≤1.

[c8] 8. The UV photodetector of claim 6, wherein a material of the ohmic contact layer comprises N-type $Al_cIn_dGa_{1-c-d}N$ semiconductor, wherein c, d ≥ 0 and 0≤c+d≤1.

[c9] 9. The UV photodetector of claim 6, wherein a material of the active layer comprises undoped $Al_eIn_fGa_{1-e-f}N$ semiconductor, wherein e, f ≥ 0 and 0≤e+f≤1.

[c10] 10. The UV photodetector of claim 1, wherein a material of the first electrode and the second electrode comprises Ni/Au, Cr/Au, Cr/Pt/Au, Ti/Al, Ti/Al/Ti/Au, Ti/Al/Pt/Au, Ti/Al/Ni/Au, Ti/Al/Ti/Au, Ti/Al/Pd/Au, Ti/Al/Cr/Au, Ti/Al/Co/Au, Cr/Al/Cr/Au, Cr/Al/Pt/Au, Cr/Al/Pd/Au, Cr/Al/Ti/Au, Cr/Al/Co/Au, Cr/Al/Ni/Au, Pd/Al/Ti/Au, Pd/Al/Pt/Au, Pd/Al/Ni/Au, Pd/Al/Pd/Au, Pd/Al/Cr/Au, Pd/Al/Co/Au, Nd/Al/Pt/Au, Nd/Al/Ti/Au, Nd/Al/Ni/Au, Nd/Al/Cr/Au Nd/Al/Co/A, Hf/Al/Ti/Au, Hf/Al/Pt/Au, Hf/Al/Ni/Au, Hf/Al/Pd/Au, Hf/Al/Cr/Au, Hf/Al/Co/Au, Zr/Al/Ti/Au, Zr/Al/Pt/Au, Zr/Al/Ni/Au, Zr/Al/Pd/Au, Zr/Al/Cr/Au, Zr/Al/Co/Au, TiN_x/Ti/Au, TiN_x/Pt/Au, TiN_x/Ni/Au, TiN_x/Pd/Au, TiN_x/Cr/Au, TiN_x/Co/Au, $TiWN_x$/Ti/Au, $TiWN_x$/Pt/Au, $TiWN_x$/Ni/Au, $TiWN_x$/Pd/Au, $TiWN_x$/Cr/Au, $TiWN_x$/Co/Au, NiAl/Pt/Au, NiAl/Cr/Au, NiAl/Ni/Au, NiAl/ Ti/Au, Ti/NiAl/ Pt/Au, Ti/NiAl/ Ti/Au, Ti/

NiAl/Ni/Au, Ti/NiAl/Cr/Au, N-type conductive indium tin oxide (ITO), cadmium tin oxide (CTO), aluminum zinc oxide (ZnO:Al), indium zinc oxide (ZnO:In), zinc gallate ($ZnGa_2O_4$), SnO_2:Sb, Ga_2O_3:Sn, $AgInO_2$:Sn, In_2O_3:Zn, P-type conductive $CuAlO_2$, LaCuOS, NiO, $CuGaO_2$or $SrCu_2O_2$.

[c11] 11. An UV photodetector, comprising:
a substrate;
a GaN-based semiconductor layer, disposed on the substrate;
a high-resistivity GaN-based interlayer, disposed on the GaN-based semiconductor layer, and a material of the GaN-based interlayer comprises $Al_xIn_yGa_{1-x-y}N$, wherein $x \geq 0$, $y \geq 0$, $1 \geq x + y$; and
a patterned electrode layer disposed on the GaN-based interlayer.

[c12] 12. The UV photodetector of claim 11, wherein the patterned electrode layer comprises a first electrode and a second electrode.

[c13] 13. The UV photodetector of claim 12, wherein the first electrode comprises a plurality of first finger-shaped protrusions, the second electrode comprises a plurality of second finger-shaped protrusions, and the first finger-shaped protrusions and the second finger-shaped

protrusionsare mutually interlaced.

[c14] 14. The UV photodetector of claim 12, further comprises a first bonding pad, wherein the first bonding pad is disposed on the first electrode.

[c15] 15. The UV photodetector of claim 12, further comprises a second bonding pad, wherein the second bonding pad is disposed on the second electrode.

[c16] 16. The UV photodetector of claim 11, wherein the substrate is comprised an aluminum oxide (sapphire) substrate, a silicon carbide (SiC) substrate, a zinc oxide (ZnO) substrate, a silicon substrate, a gallium phosphide (GaP) substrate, and a gallium arsenide (GaAs) substrate.

[c17] 17. The UV photodetector of claim 11, wherein the high-resistivity GaN-based interlayer is constructed by doping at least one dopant selected from a group consisting of iron (Fe), magnesium (Mg), zinc (Zn), copper (Cu), arsenide (As), phosphorus (P), carbon (C) and beryllium (Be) or by a GaN-based semiconductor layer formed by a low temperature process (a temperature of growth less than 800°C).

[c18] 18. The UV photodetector of claim 11, wherein the GaN-based semiconductor layer comprising:
a nucleation layer, disposed on the substrate; and

an active layer, disposed on the nucleation layer.

[c19] 19. The UV photodetector of claim 18, wherein a material of the nucleation layer comprises $Al_aIn_bGa_{1-a-b}N$ semiconductor, wherein a, b ≥ 0 and 0≤a+b≤1.

[c20] 20. The UV photodetector of claim 18, wherein a material of the active layer comprises undoped $Al_eIn_fGa_{1-e-f}N$ semiconductor, wherein e, f ≥ 0 and 0≤e+f≤1.

[c21] 21. The UV photodetector of claim 11, wherein a material of the patterned electrode layer comprises Ni/Au, Cr/Au, Cr/Pt/Au, Ti/Al, Ti/Al/Ti/Au, Ti/Al/Pt/Au, Ti/Al/Ni/Au, Ti/Al/Ti/Au, Ti/Al/Pd/Au, Ti/Al/Cr/Au, Ti/Al/Co/Au, Cr/Al/Cr/Au, Cr/Al/Pt/Au, Cr/Al/Pd/Au, Cr/Al/Ti/Au, Cr/Al/Co/Au, Cr/Al/Ni/Au, Pd/Al/Ti/Au, Pd/Al/Pt/Au, Pd/Al/Ni/Au, Pd/Al/Pd/Au, Pd/Al/Cr/Au, Pd/Al/Co/Au, Nd/Al/Pt/Au, Nd/Al/Ti/Au, Nd/Al/Ni/Au, Nd/Al/Cr/Au Nd/Al/Co/A, Hf/Al/Ti/Au, Hf/Al/Pt/Au, Hf/Al/Ni/Au, Hf/Al/Pd/Au, Hf/Al/Cr/Au, Hf/Al/Co/Au, Zr/Al/Ti/Au, Zr/Al/Pt/Au, Zr/Al/Ni/Au, Zr/Al/Pd/Au, Zr/Al/Cr/Au, Zr/Al/Co/Au, TiN_x/Ti/Au, TiN_x/Pt/Au, TiN_x/Ni/Au, TiN_x/Pd/Au, TiN_x/Cr/Au, TiN_x/Co/Au, $TiWN_x$/Ti/Au, $TiWN_x$/Pt/Au, $TiWN_x$/Ni/Au, $TiWN_x$/Pd/Au, $TiWN_x$/Cr/Au, $TiWN_x$/Co/Au, NiAl/Pt/Au, NiAl/Cr/Au, NiAl/Ni/Au, NiAl/ Ti/Au, Ti/NiAl/ Pt/Au, Ti/NiAl/ Ti/Au, Ti/NiAl/Ni/Au, Ti/NiAl/Cr/Au, N-type conductive indium tin

oxide (ITO), cadmium tin oxide (CTO), aluminum zinc oxide (ZnO:Al), indium zinc oxide (ZnO:In), zinc gallate ($ZnGa_2O_4$), SnO_2:Sb, Ga_2O_3:Sn, $AgInO_2$:Sn, In_2O_3:Zn, P-type conductive $CuAlO_2$, LaCuOS, NiO, $CuGaO_2$or $SrCu_2O_2$.